Analyzing hotel efficiency from a regional perspective: The role of environmental determinants

Ricardo Sellers-Rubio[a], Ana B. Casado-Díaz[a]

[a] Department of Marketing, University of Alicante, E-03080, Alicante, Spain

ricardo.sellers@ua.es, ana.casado@ua.es

Please, cite as:

Sellers-Rubio, R. y Casado-Diaz, A.B. (2018) "Analyzing hotel efficiency from a regional perspective: The role of environmental determinants". International Journal of Hospitality Management. Vol 75, Septiembre, pp. 75-85. DOI: 10.1016/j.ijhm.2018.03.015

Abstract

With the development of the tourism industry over the last three decades, there has been growing interest in evaluating the efficiency of the hotel industry from a regional perspective. This paper joins this stream of research and assesses the performance of the Spanish hotel industry using a two-stage double bootstrap data envelopment analysis methodology. Additionally, we extend research on the impact of environmental variables on efficiency by examining the impact of four variables: length of stay, number of international tourists, destination quality, and the sun and sand tourism model. The results show a high degree of hotel inefficiency for Spanish regions and a significant effect of the environmental variables considered. These results give policymakers more accurate information for future strategic decisions, especially because that tourism constitutes a strategic sector of Spain's national economy.

Keywords:

DEA, Hotel, Efficiency, Destination quality, Environmental determinants, International attractiveness, Spain

1. Introduction

Tourism constitutes an important source of economic growth for many countries (Eurostat, 2017). The hotel industry is both a capital factor in such development and a source of research interest.

Over the last two decades, several studies have examined the efficiency of the hotel industry. These studies differ mainly in the sample used, the methodology applied, and their attempts to explain hotel efficiency by means of (different) specific determinants. For the sample, most previous studies focused on measuring efficiency by hotel (brand) and/or examined a reduced sample of hotels at a concrete (geographically limited) destination. In this context, the present paper follows the works of Porter (1998) and Crouch and Ritchie (1999) and relies on the interconnection that exists between the destinations (i.e., the specific geographical area in which the tourist spends some time) and the hospitality firms located in them (i.e., hotels). Governments and researchers are increasingly concerned about the efficiency not only of hotels but also of tourism destinations (Cracolici & Nijkamp, 2008; Gomezeljn & Mihalic, 2008). One of the elements that deserve more research attention is the destination performance at the regional hotel sector level. The main question is whether hotels operate efficiently, i.e., whether they use (scarce) resources in an efficient way. Despite the importance of destination performance, research on hotel efficiency at a regional level is limited (Barros et al., 2011; Benito, Solana, & López, 2014; Botti, Peypoch, Robinot, & Solonandrasana, 2009; Brida, Garrido, Deidda, & Pulina, 2012; Detotto, Pulina, & Brida, 2014; Guccio, Lisi, Martorana, & Mignosa, 2017; Huang, Mesak, Hsu, & Qu, 2012; Pulina, Detotto, & Paba, 2010; Solana-Ibáñez, Caravaca-Garratón, & Para-González, 2016). Assaf, Josiassen, Woo, Agbola, and Tsionas (2017) recently called for more research on specific destinations. Thus, the main focus of this study is to assess the efficiency of the hotel industry at a regional level.

The second research objective of this study is to examine the impact of different drivers on regional hotel efficiency. As noted by Assaf, Barros, and Josiassen (2012), most efficiency studies do not include environmental (contextual) variables. Very recent research by Assaf and his colleagues has highlighted the need for more research on the determinants of efficiency, such as destination characteristics (Assaf & Josiassen, 2016; Assaf et al., 2017). In this paper, we aim to extend this stream of research by examining the impact of four environmental variables that have not been used previously together to explain regional hotel efficiency. These include length of stay, number of international tourists (characteristics related to the market), destination quality and the sun and sand tourism model (characteristics related to the specific destination). We employ the two-stage double bootstrap data envelopment analysis (DEA) methodology proposed by Simar and Wilson (2007) to estimate regional hotel efficiency and to examine the effect of the proposed environmental variables on efficiency.

Finally, this research contributes to the literature by focusing on Spain, which is a leading country in the tourism sector. Given the huge competitiveness in the country and the rise of new international destinations, there is a clear need to better understand Spanish hotels' efficiency. This task requires better knowledge of the geographical diversity of Spain, as reflected by the different regions (also named autonomous communities) into which it is politically and administratively divided, which constitute the units of analysis of this research. Autonomous communities in Spain play a major role and have great independence from the central government in relation to many issues, including tourism planning (Ivars-Baidal, 2004). Thus, the quantification of possible hotel efficiency differences at a regional level and the identification of some relevant determinants of such differences are of great interest and relevance from a regional tourism policy perspective.

The rest of the paper is structured as follows. The next section reviews the study context and discusses the determinants of regional hotel efficiency. Section 3 presents the research methodology, the data and the variables used. Section 4 presents the empirical results, and section 5 summarizes the key findings and discusses the implications.

2. Research framework

2.1. Efficiency in the hotel industry

In the context of the tourism sector, the importance of evaluating hotel efficiency has been widely supported. Using different techniques to estimate efficiency, it is possible to determine how effectively a hotel is using resources and to identify factors that are beyond managers' control (Reynolds, 2003). Thus, several studies have centered on examining hotel efficiency (see Assaf & Josiassen, 2016, for a recent review). These studies differ mainly in the type of inputs and outputs employed, the sample considered and/or the methodology applied.

Regarding the variables used, Barros and Dieke (2008) summarized the inputs and outputs traditionally included in hotel efficiency studies. Normally, the selection of variables is driven by the availability of information and researcher criteria. Ball, Johnson, and Slattery (1986) suggested that three broad categories of variables are essential: financial, physical and composite (reflecting financial and physical variables). Among the inputs, physical variables such as the number of employees (e.g., Anderson, Fish, Xia, & Michello, 1999; Hwang and Chang, 2003) and the number of available rooms (Assaf, Josiassen, Cvelbar, & Woo, 2015; Barros, 2005b; Johns, Howcroft, & Drake, 1997) are usually employed. Furthermore, several authors have included financial variables, such as salaries paid (e.g., Barros, 2005a; De Jorge & Suárez, 2014; Morey & Dittman, 1995) and food and beverage costs (e.g., Anderson, Fok, & Scott, 2000; Wang, Lee, & Wong, 2007). Among the outputs, total revenues and sales are the most commonly employed variables (e.g., Anderson et al., 1999; Barros & Alves, 2004; Shang, Hung, Lo, & Wang, 2008). In addition, new variables have been examined in recent years, such as customer satisfaction (e.g., Assaf & Magnini, 2012) and employee satisfaction, which, as Reynolds and Biel (2007) highlighted, complete a truly holistic and accurate productivity assessment.

As for the sample, most previous studies have focused on measuring efficiency by hotel (brand) and/or have examined a reduced sample of hotels in a concrete (geographically limited) destination. In this sense, most papers refer to the USA (e.g., Anderson, Fish, Xia, & Michello, 1999; Brown & Ragsdale, 2002; Morey & Dittman, 1995), Asia (e.g., Hwang & Chang, 2003; Wang, Lee, & Wong, 2007) or Western Europe (e.g., Portugal: Barros & Alves, 2004; Barros, 2005a; or Spain: De Jorge & Suárez, 2014).

The literature on hotel efficiency has also used various methods of analysis, with the most common being the non-parametric technique of DEA (e.g., Barros, 2005b; Johns, Howcroft, & Drake, 1997; Tsaur, 2001) and a parametric stochastic frontier (Barros, 2004; Oliveira, Pedro, & Marques, 2013; Weng & Wang, 2006). Recent works have developed more complex methods to examine hotel efficiency and to overcome some of the inherent limitations of previous approaches. For example, Assaf et al. (2012) proposed a metafrontier method to account for the environmental and technological differences in hotel efficiency, whereas other authors have utilized bootstrapping techniques (e.g., Assaf & Cvelbar, 2010; Yin, Tsai, & Wu, 2015).

Finally, although many papers have focused on estimating hotel efficiency (e.g., Barros, 2005b; Hwang & Chang, 2003; Morey & Dittman, 1995), a more recent stream of research has gone further and tried to explain the efficiency results by means of different variables (e.g., Assaf & Josiassen, 2012; Assaf et al., 2012; Yang, Xia, & Cheng, 2017). In this sense, Assaf and Josiassen (2012) presented a list of the determinants that affect tourism performance, which include destination attractiveness (e.g., tourism resources), business environment (e.g., nearby retail malls), regional image and profile (e.g., environmental quality) and supportive factors (e.g., transportation facilities and internet services). Some studies have highlighted the importance of internal (endogenous) factors, such as corporate and management strategies (e.g., Hwang & Chang, 2016; Xiao, O'Neill, & Mattila, 2012). However, as noted recently by Assaf, Josiassen, and Agbola (2015) and Yang and Cai (2016), destination-related external (exogenous) factors are probably even more important determinants of hotel performance than internal ones are; nevertheless, the former have surprisingly been less studied.

To overcome this limitation, we aim to extend the research on the impact of environmental variables on hotel efficiency at a regional level.

2.2. Hotel efficiency at a regional level

Governments are increasingly concerned about the performance of tourism activities, given their huge economic and social impacts, although the number of studies on the hotel industry from a regional perspective is quite small (Barros et al., 2011). Following this stream of research, there have been recent attempts to examine hotel efficiency at a regional level in France, China, Italy and Spain (see Table 1).

Table 1.
Summary of the hotel efficiency literature focused on regional differences

Authors/Sample/Method	Variables Employed
Barros et al. (2011)	Inputs
	Accommodation capacity
France (2003–2007), 22 regions	Tourist arrivals
Stochastic-DEA	Outputs
	Number of bed-nights
	Efficiency determinants (tourism attractions)
	Number of monuments, number of museums, number of theme parks, number of kilometers of beaches, presence of ski resorts, presence of natural parks, yearly trend
Benito et al. (2014)	Inputs
	Accommodation capacity
Spain (2002–2010), 17 regions	Tourist arrivals
Stochastic-DEA	Outputs
	Number of bed-nights
	Efficiency determinants (tourism attractions)
	Coastal destination, number of cultural properties, number of museums and collections, percentage of meeting attendance, natural surface, number of federated golf clubs, presence of ski resorts, number of restaurants, number of retailers
Botti et al. (2009)	Inputs (tourism attractions and accommodation capacity)
	Hotels
France (2006), 22 regions	Camping
DEA-Directional Distance	Parks
Function	Monuments
	Beach kilometers
	Museums
	Outputs
	Arrivals
	Efficiency determinants

	(not examined)
Brida et al. (2012) Italy (2000–2004), 19 regions and 2 provinces DEA	Inputs Labor costs Gross fixed investment Outputs Sales revenue Value added Efficiency determinants (not examined)
Detotto et al. (2014) Italy (2000–2004), 19 regions and 2 provinces Window-DEA	Inputs Labor costs Gross fixed investment Outputs Sales revenue Value added Efficiency determinants Net rate of utilization of bed-places, annual coefficient of variation of the net rate of utilization, art city (Rome, Florence and Venice), share of high-quality hotels per region (ration between number of 4- and 5-star hotels and total number of hotels)
Guccio et al. (2017) Italy (2004–2010), 19 regions and 2 provinces *order-m* method	Inputs Accommodation capacity Tourist arrivals Outputs Tourist bed-nights Efficiency determinants (cultural participation indexes) Number of persons who have attended at least once in the last 12 months, per 100 inhabitants with more than 6 years: theaters, cinemas, museums and exhibitions, classical music concerts and operas, other music concerts, sports shows, discotheques and dance halls, archaeological sites and monuments; monthly average household expenditure on leisure and culture; per capita annual average expenditure on theatrical and musical performances; tickets sold for theatrical and musical performances per 100 inhabitants; number of visitors to museums and similar institutes—both state and nonstate—per 100 inhabitants (year 2011); number of museums and similar institutes—both state and nonstate—per 100,000 inhabitants (year 2011)
Huang et al. (2012) China (2001–2006), 31 regions Window-DEA	Inputs Total number of full-time employees in a regional hotel sector Total number of guest rooms in a region Total fixed assets in a regional hotel sector Outputs Total revenue Average occupancy rate Efficiency determinants Historical average technical efficiency score, richness of tourism resources (percentage of national A-grade tourist attractions), international tourism attractiveness (ratio of inbound arrivals received to total inbound arrivals in China), education (proportion of urban employees with senior high school education or higher), payment levels of employees (average annual earnings of employees), market competition (number of hotels), regional trade openness (ratio of trade over regional GDP), time (dummy that takes the value of 1 for all DMU in year 2003–SARS outbreak)
Pulina et al. (2010)	Inputs

Italy (2002–2005), 19 regions and 2 provinces Window-DEA	Labor cost Outputs Sales revenue Value added Efficiency determinants Size, efficiency (applied only to Sardinia as a case study)
Solana-Ibáñez et al. (2016) Spain (2005–2013), 17 regions DEA (SBM)/Malmquist productivity index	Inputs Number of beds available Number of nights a traveler stayed at one establishment Outputs Number of people staying at least one night at an establishment Efficiency determinants (tourism attractions and services) Coastal destination, number of cultural properties, number of museums and collections, percentage of meeting attendance, nature (this measure is not specified in the article), number of federated golf clubs, number of restaurants, number of retailers

The present study adds to this literature and examines to what extent hotels located in the different Spanish regions maximize the outputs from the inputs considered. Spain is one of the world's leading tourism markets and topped the 2017 edition of the Travel & Tourism Competitiveness Index (TTCI; World Economic Forum, 2017). Tourism is central to the Spanish economy, with the hotel sector being one of the main pillars. In fact, Spain is known as the most tourist-friendly country in the world, and its tourism service infrastructure is particularly sound, reaching second in the TTCI ranking in this regard (World Economic Forum, 2017). According to Eurostat (2017), Spain recorded the highest tourism gross value added, at 58% in the 16 countries for which data were available. The report also highlighted that the nights spent in tourist accommodations in Spain represented 15.1% of the EU-28 total (404 million nights). Although these figures are impressive and tourism constitutes a strategic sector of Spain's national economy, works focused on hotel efficiency in Spain are quite recent and limited in number (Arbelo-Pérez, Arbelo, & Pérez-Gómez, 2017; Benito et al., 2014; De Jorge & Suárez, 2014; Fernández & Becerra, 2015; Parte-Esteban & Alberca-Oliver, 2015a, 2015b; Pérez-Rodriguez & Acosta-González, 2007; Solana-Ibáñez et al., 2016). Within this context, the works of Benito et al. (2014) and Solana-Ibáñez et al. (2016) have been the only attempts to measure Spanish hotel efficiency on a regional basis.

This paper follows and aims to expand the stream of extant research on the impact of environmental variables on hotel efficiency at a regional level. As stated above, destination-related external (exogenous) factors are crucial determinants of hotel performance. Broadly speaking, destination-related variables that might determine efficiency can be classified as (i) market variables (e.g., number of tourist arrivals at the destination, length of stay and average spending of tourists) and (ii) destination characteristics (e.g., degree of competition in the area and tourist attractors). In the specific context of this study, the few works available present substantial differences in the choice of variables (see Table 1). Benito et al. (2014) and Solana-Ibáñez et al. (2016), which are the only studies to have analyzed Spanish regional hotel efficiency, both used destination characteristics. Their choice was based on a Spanish report, *Monitoring the Competitiveness of the Spanish Regions* (MoniTUR Report), and they selected only the tourism attractors they considered to strongly influence the competitiveness of Spanish regions. Barros et al. (2011) also employed tourism attractions, which are similar to, though not the same as, those of the Spanish authors. Detotto et al. (2014), Guccio et al. (2017), Huang et al. (2012) and Pulina et al. (2010) used quite different determinants, such as size, cultural participation or art city. A few papers have also considered market variables.

Among the few that have, Huang et al. (2012) included the ratio of inbound arrivals received to total inbound arrivals, whereas Guccio et al. (2017) considered the average spending of tourists.

Given their importance for the Spanish tourist market, in this paper, we consider two characteristics related to the market (length of stay and number of international tourists) and two characteristics related to the specific destination (destination quality, and the sun and sand tourism model). The relevance of these variables can be explained in the following way.

The length of stay is important because the number of days spent by tourists (both national and international) in Spanish hotels has fallen in recent decades. According to data from Hospitality and Tourism Surveys (Spanish National Statistical Institute [INE]) the average length of stay in 1999 was 3.83 days, whereas this number decreased to 3.22 days in 2015. In this sense, understanding the impact of this variable is vital because the cost of acquiring a new customer is higher than that of retaining a customer for a greater number of days in the destination.

The number of international tourists is a relevant variable according to INE (2016), given the importance that these tourists have in terms of expenditures (€77,415 million in 2016). In fact, the average per capita daily spending of international tourists is higher (€130 in 2016) than the average per capita daily spending of national tourists (€53.04 in 2016). This tendency towards higher spending could influence hotels' efficiency.

Destination quality is also worth examining, given that quality constitutes a key competitive advantage in the highly competitive hotel sector (Akbaba, 2006; Chen, 2013). Although a quality strategy might add value to a hotel's price strategy compared to the star category (Abrate, Capriello, & Fraquelli, 2011), previous research has not been clear regarding the predicted relationship between quality and hotel efficiency. In this sense, the Spanish tourism sector has made huge efforts to improve service quality, with more tourist destinations and establishments than ever achieving and adopting quality systems. 3,187 destinations and establishments received the Spanish quality designation "Compromiso de Calidad Turística" (Tourism Quality Commitment) in 2008, whereas 5,263 destinations received this designation in 2016, representing a 65% increase.

Finally, this paper also considers the prevalence of the sun and sand tourism model in the destination. Although this mature model faces many challenges, it remains the most important model and centers on the primary reason international tourists visit Spain and national tourists go on vacation.

In the next subsections, we develop hypotheses regarding the previous environmental variables.

2.2.1. Length of stay

The length of stay is related to market characteristics, outside the company, and denotes "the amount of time that the tourist spends at a given destination" (Oliveira-Santos, Ramos, & Rey-Maquieira, 2015, p. 788). This temporal aspect of the vacation is of great interest for the tourism industry and policy, as longer-stay tourists generate more economic, social and environmental impacts compared to shorter-stay tourists (Barros & Machado, 2010). In line with Botti, Peypoch, and Solonandrasana (2008), we consider length of stay to be an appropriate proxy of a region's attractiveness that focuses on the tourist's perception of the destination: if the tourist stays longer, it means that the destination reaches an acceptable level of attractiveness. Therefore, we hypothesize the following:

Hypothesis 1. *Length of stay has a positive impact on regional efficiency scores.*

2.2.2. *International tourist arrivals*

Previous research has found that foreign tourist arrivals have a great impact on hotel efficiency and performance (Assaf et al., 2017; Ben Aissa & Goaied, 2016; Chen, 2010; Huang et al., 2012; Hwang & Chang, 2003). On the one hand, an "export" hotel orientation contributes to reducing the dependence on local markets. This is particularly important because international visitors stay longer and have a higher travel budget compared to domestic tourists (Rosenbaum & Spears, 2006). In fact, research has shown a positive relationship between hotel performance and hotel orientation to international customers (Bernard & Jensen, 2004; Rosenbaum & Spears, 2006). On the other hand, the ability of a destination to attract new visitors is a sign of destination competitiveness (Ritchie & Crouch, 2003) and enhances knowledge of productivity (Bernard & Jensen, 2004). Moreover, international arrivals constitute a key indicator of the World Economic Forum's TTCI (World Economic Forum, 2017), which is probably the most important source of destination competitiveness globally speaking, and reflects the attractiveness of tourist destinations.

Specifically, Assaf et al. (2017) concluded that the number of international arrivals is one of the strongest facilitators of hotel performance. Chen (2010) found that international tourist arrivals were significant in explaining the growth of the Taiwan hotel industry in the period analyzed (1997–2008). Hwang and Chang (2003) showed that the hotels in Taiwan whose customers are mainly foreigners achieve better efficiency than those servicing only local customers. Ben Aissa and Goaied (2016) also found that international tourists had a positive impact on hotel efficiency scores in a panel of 27 Tunisian hotels (2000–2010). A similar result, but applied to the hotel efficiency of Chinese regions, was found by Huang et al. (2012). Thus, we propose the following:

Hypothesis 2. *International tourist arrivals have a positive impact on regional efficiency scores*.

2.2.3. *Destination quality*

Quality constitutes a key advantage in the highly competitive hotel sector (Akbaba, 2006; Chen, 2013). One of the usual measures of quality in the context of the hotel industry is the hotel category (number of stars). The star-rating system is a well-known standard used to rate hotels everywhere and implies a positive relationship between hotel attributes (hotel quality) and ranking (Abrate et al., 2011). It constitutes "a mechanism for addressing the problem of asymmetric information inherent to this market in the relationship between consumers and producers" (Núñez-Serrano, Turrión, & Velázquez, 2014, p. 85). Hotel star ratings have been used as a determinant of holiday package prices and hotel prices (e.g., Aguiló, Alegre, & Riera, 2001; Espinet, Saez, Coenders, & Fluvià, 2003; Taylor, 1995; Thrane, 2005) and, more recently, as a determinant of the profit efficiency of hotels (Arbeló-Pérez et al., 2017). However, López-Fernández and Serrano-Bedia (2004) and Núñez-Serrano et al. (2014) questioned the usefulness of stars as a good indicator of hotel quality, given the differences between customer expectations and perceptions of hotel quality and the hotel category, and the heterogeneity of the different classification systems used and the administrations involved in their regulation and assignment, which is particularly problematic in the Spanish regions. In fact, recent works applied to the Portuguese hotel sector have found that the hotel star rating is not relevant to hotel efficiency (Oliveira, Pedro, & Marques, 2013a, 2013b).

To overcome the above problems associated with the star-rating system, this study proposes that adherence to quality assurance programs could also be used as a measure of quality and a source of consumer information. Abrate et al. (2011) analyzed the effect of quality signals on price differentials among Turin's hotels. As a quality signal, the authors used the number of hotels adhering to the quality assurance program introduced by the Turin Chamber of Commerce. Their results show that adherence to quality assurance programs adds even more value to hotel price strategies than the star category. Fernández and Becerra (2015) used environment quality certificates to examine hotel efficiency and found a negative and statistically significant effect for the whole sample. This effect was positive for medium-category hotels (2–3 stars) but negative for high-category hotels (4–5 stars). Claver-Cortés, Molina-Azorín, and Pereira-Moliner (2007) employed the number of quality certificates in a sample of 81 3–4-star hotels located in Benidorm (Alicante, Spain). The authors found that the number of quality certificates was positively related to hotel performance. Ingram and Daskalakis (1999) examined a sample of ISO-accredited hotels in Crete and concluded that quality accreditation frameworks do not ensure customer satisfaction. Thus, past research has presented inconsistencies regarding the predicted sign of the relationship between quality and hotel efficiency. Therefore, we hypothesize the following:

Hypothesis 3. *Adherence to quality assurance programs influences regional efficiency scores*.

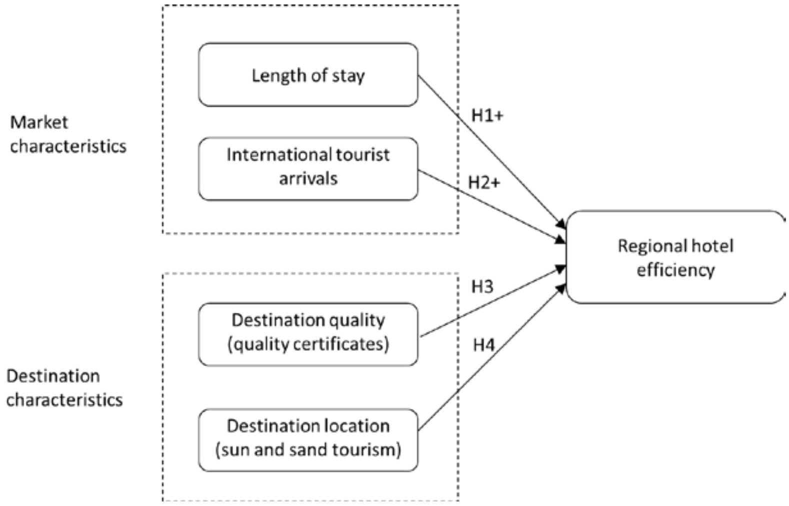
2.2.4. Destination location: Effect of sun and sand model

Location has been proven to influence hotel profitability and competitive position, because it can determine the level of hotel occupancy and hotel externalities such as knowledge transmission and the concentration of skilled workers (Lado-Sestayo, Otero-González, Vivel-Búa, & Martorell-Cunill, 2016). Coastal tourist areas may have a higher efficiency than, for instance, artistic-cultural areas (Cracolici, Nijkamp, & Rietveld, 2008). In this study, we examine the potential differences in regional efficiency derived from the dominance of sun and sand tourism, a location characteristic. Some authors have argued that destinations adopting sun and sand mass tourism follow a Fordist production model, trying to achieve economies of scale with highly standardized products and a lack of differentiation (Aguiló, Alegre, & Sard, 2005; Aguiló & Juaneda, 2000; Knowles & Curtis, 1999). Others have argued that these destinations follow a neo-Fordist model and can re-adapt their strategies to fulfill (new) market requirements instead of simply declining and becoming unsustainable (Ioannides & Debbage, 1997). Although sun and sand tourism is quite important in Spain, many other forms of tourism have developed worldwide and the debate about their competitiveness and long-term sustainability is still open (Aguiló et al., 2005; Claver-Cortés et al., 2007). Therefore, examining the impact of this form of tourism on differences in regional hotel performance is of great interest. Based on the above, we develop the following hypothesis:

Hypothesis 4. *Coastal destinations present differences in hotel efficiency scores derived from their sun and sand tourism orientation*.

A summary of the conceptual model considering the effects of the different environmental variables on regional efficiency scores is presented in Figure 1.

Fig. 1 Conceptual model



3. Method

This section describes the methodology used in this study, the sample, and the measures employed to operationalize the variables.

3.1. Methodology

In this paper, we employ the two-stage double bootstrap methodology proposed by Simar and Wilson (2007), which simultaneously estimates efficiency and the effect of the environmental variables considered.

To estimate efficiency, we employ a stochastic DEA model. DEA is a non-parametric technique originally developed by Charnes, Cooper, and Rhodes (1978, 1981) and is widely employed to estimate efficiency in the tourism industry. Generally, DEA considers the existence of n decision-making units (DMU) that employ a vector of m inputs (X_{im}) to obtain a vector of s outputs (Y_{is}). In this paper, we employ the output-oriented variable returns to scale model (Banker, Charnes, & Cooper, 1984), so for each DMU the following linear programming model must be solved:

$$\max\left\{\delta / \sum_{i=1}^{n} y_{ir}\lambda_i \geq \delta y_{r0};\ \sum_{i=1}^{n} x_{ij}\lambda_i \leq x_{j0}; \sum_{i=1}^{n}\lambda_i = 1; \lambda_i \geq 0\right\} \quad (1)$$

where $i = 1,...,n;\ r = 1,...,s;\ j = 1,...,m$. $\hat{\delta}_i$ is the efficiency score for the DMU analyzed. A DMU is considered efficient if $\hat{\delta}_i = 1$ and inefficient if $\hat{\delta}_i > 1$. As the score increases, the efficiency decreases. The difference between the estimated efficiency score and the unit determines the potential output growth required to reach the frontier and become efficient.

One disadvantage of the DEA model is its deterministic nature. In this sense, input and output values are subjected to errors and noise, which can cause bias and error in the efficiency scores. To overcome this limitation, Simar and Wilson (1998, 2000a, 2000b) implemented a bias-corrected DEA approach. The underlying idea of this approach is to build a smooth bootstrap sample from the original data set in an appropriate way.

Further, the current paper considers the effect of environmental variables on efficiency. In this sense, a second-stage truncated regression model is estimated. From the efficiency DEA scores ($\hat{\delta}_i$), we estimate a regression model that considers these estimates as the dependent variable and a set of Z_i variables as independent variables:

$$\hat{\delta}_i = f(Z_i, \beta_i) + \varepsilon_i \qquad (2)$$

where ε_i is a random variable distributed $N(0, \sigma_i)$. The estimation of the parameters $\hat{\beta}_i$ might allow identification of the effect of the Z_i variables on efficiency. However, as the efficiency estimates in the first stage (dependent variable) are built from the whole data set, this estimation could be biased, as the DEA efficiency scores are correlated (Simar & Wilson, 2011). To overcome this problem, Simar and Wilson (2007) proposed a two-stage double bootstrap methodology that consists of the following steps:

1. Solve equation (1) and obtain output-oriented traditional DEA efficiency estimates $(\hat{\delta}_i)$ for all the firms in the original data set.
2. Estimate using maximum likelihood a truncated regression considering $\hat{\delta}_i$ as the dependent variable and a set of (Z_i) explanatory variables yielding estimates of the parameters $(\hat{\beta}_i, \hat{\sigma}_\varepsilon)$.
3. For each firm (i=1,…,n) in the sample repeat the following four steps (a–d) L_1 times, to obtain a set of L_1 bootstrap estimates $\left\{\hat{\delta}^*_{i,L}; L = 1, ..., L_1\right\}$:
    a. For each firm (i=1,…,n), draw ε_i from the left truncated $(1 - \hat{\beta}_\varepsilon Z_i)$ distribution of $N(0, \hat{\sigma}^2_\varepsilon)$.
    b. For each firm (i=1,…,n), compute $\delta^*_i = \hat{\beta} Z_i + \varepsilon_i$.
    c. Construct a pseudo data set (x^*_i, y^*_i), where $x^*_i = x_i$ and $y^*_i = \hat{y}_i \hat{\delta}_i / \delta^*_i$.
    d. Using the pseudo data (x^*_i, y^*_i), estimate pseudo efficiency DEA estimates $\hat{\delta}^*_i$.
4. For each firm i=1,…,n, compute a bias-corrected efficiency estimator $(\hat{\hat{\delta}}_i)$ where $\hat{\hat{\delta}}_i = \hat{\delta}_i - bi\hat{a}s_i$ and

$$bi\hat{a}s_i = \frac{\sum_{L=1}^{L_1} \hat{\delta}^*_{i,L}}{L_1} - \hat{\delta}_i$$

5. Employing a truncated regression estimated by maximum likelihood, regress the previous efficiency estimates $(\hat{\hat{\delta}}_i)$ on Z_i to estimate the parameters $(\hat{\beta}_i, \hat{\sigma}_\varepsilon)$.
6. Repeat the following three steps (a–c) L_2 times to obtain bootstrap estimates of $\left\{\hat{\beta}^*_{L\,i}, \hat{\sigma}^*_L; L = 1, ..., L_2\right\}$:
    a. For each firm (i=1,…,n), draw ε_i from the left-truncated $(1 - \hat{\beta}_\varepsilon Z_i)$ of $N(0, \hat{\sigma}^2_\varepsilon)$.
    b. For each firm (i=1,…,n), compute $\delta^{**}_i = \hat{\beta} Z_i + \varepsilon_i$.
    c. Employing a truncated regression estimated by maximum likelihood, regress δ^{**}_i on Z_i to estimate the following parameters: $(\hat{\beta}^*{}_i, \hat{\sigma}^*)$

7. From the previous values, compute confidence intervals for the parameters of the regression and the efficiency estimates.

Finally, the only remaining issue concerns the choice of the number of replications, L_1 and L_2. The choice of L_1 determines the number of bootstrap replications to compute the bias-corrected efficiency scores, whereas L_2 determines the number of bootstrap replications to compute the confidence intervals. Usually, L_1 is set to 100 and L_2 is set to 2000. The confidence intervals are estimated at 95%. To implement this methodology, we use the rDEA library of the statistical package R.

3.2. Sample and variables

The empirical analysis is carried out using data from the hotel industry in Spain between 2008 and 2016. We employ monthly data from the hotel industry established in the different Spanish autonomous regions. In this sense, we obtain data for the inputs, outputs and environment for every region and month and consider every month as a single decision-making unit (DMU) to estimate efficiency. Then, we aggregate these monthly estimates to obtain the annual scores. Although most previous papers in this area considered annual data, the inclusion of monthly data allows us to capture the seasonality effect to determine whether hotels are efficient because of clever management or because they benefit from a positive environment.

As in the previous studies on regional hotel efficiency, the DMU is the hotel sector in a particular region in Spain. Selection of inputs and outputs is based on the literature review and the availability of reliable data sources. Data are obtained from the Spanish National Institute of Statistics (INE, www.ine.es). This study employs three input indicators: (1) number of hotels in the region, (2) number of available hotel beds in the region, and (3) number of full-time-equivalent employees of hotels in the region. Three outputs are considered: (1) average daily rate (ADR), (2) revenue per available room (RevPAR), and (3) average occupancy rate, calculated by the ratio between total occupied room nights and total available room nights. To consider the effect of the environment, four variables are employed: (1) average length of stay (total number of days that, on average, tourists stay at the hotels); (2) number of international tourists arriving in Spain; (3) dominance of the sun and sand tourist product, which is measured through a dummy variable that takes the value of 1 for regions located on the Mediterranean coast and the islands (Balearic and Canary Islands) and 0 otherwise; and (4) number of hotels distinguished with a quality distinction, named “Compromiso de Calidad Turística” (Tourism Quality Commitment). This distinction is managed by the Spanish Tourism Institute (Turespaña) and accredits the hotel as meeting the quality requirements established by the proposed methodology (SICTED, “Sistema Integral de Calidad Turística Española en Destinos”). In particular, this quality distinction recognizes the hotel’s effort and commitment to quality and to continuous improvement.

Descriptive statistics and correlations between the variables are presented in Tables 2 and 3, respectively.

Table 2
Descriptive statistics (2008–2016, monthly basis, n=1836)

	Mean	S.D.	Max.	Min.
Hotels (number)	869	658	2719	106
Employees (number)	11171	12966	56773	665
Available beds (number)	83129	90201	348749	5099
ADR (€)	64.359	12.029	119.000	45.500
RevPAR (€)	31.918	16.462	111.620	8.580
Occupancy rate (%)	47.493	16.223	93.1500	17.700
Length of stay (days)	2.638	1.516	8.380	1.520
International tourists (number)	5046585.359	1899412.719	10104273.000	2517979.788
Sun and sand (dummy)	0.35	0.478	1	0
Q-Hotels	46.902	43.614	228	0

Table 3
Pearson correlation indexes among variables

	Hotels	Empl.	Beds	ADR	RevPAR	Occup.	Stay	Tourists	Sun and sand	Q Hotels
Hotels	1									
Employees	0.593a	1								
Beds	0.693a	0.982a	1							
ADR	0.268a	0.575a	0.515a	1						
RevPAR	0.240a	0.705a	0.640a	0.892a	1					
Occupancy	0.192a	0.694a	0.638a	0.737a	0.951a	1				
Stay	0.128a	0.167a	0.161a	0.293a	0.453a	0.496a	1			
Tourists	0.031	0.763a	0.680a	0.373a	0.606a	0.671a	0.100a	1		
Sun and sand	0.319a	0.699a	0.706a	0.314a	0.453a	0.513a	0.000	0.680a	1	
Q-Hotels	0.390a	0.390a	0.423a	0.199a	0.251a	0.237a	0.283a	0.075a	0.300a	1

Note: (a) $p< 0.01$

4. Results

4.1. Efficiency of the hotel industry in the Spanish regions

Regional hotel efficiency was estimated using two different models: the traditional output-oriented DEA model with variable returns to scale (hereafter called the DEA model) and the bias-corrected DEA model (hereafter called the DEA-BC model). The results obtained (see Table 4) show that the average hotel efficiency for the regions between 2008 and 2016 varies between 1.494 (DEA model) and 1.547 (DEA-BC model), which reflects a high degree of inefficiency. At this point, it should be kept in mind that the efficiency scores reflect the mode of inefficiency (Shepard's estimate), so the higher the score is, the greater the inefficiency is. In this sense, these values imply that, on average, hotels located in the different regions could have achieved 49.4% higher outputs under the DEA model and 54.7% higher outputs under the DEA-BC model using the same levels of inputs.

Although efficiency scores estimated under the DEA-BC model are higher than efficiency scores estimated under the traditional DEA model, the results evidence a high correlation between these estimates (Pearson=0.968; p=0.000). However, the Wilcoxon test detected significant differences between the median levels of efficiency (Z=-37.113; p=0.000). Table 4 also shows the bias and the lower and upper bounds of the efficiency estimates confidence intervals estimated with bootstrapping. The biases are substantial for many regions. Furthermore, the confidence intervals estimated are wide, which proves the high statistical variability of the efficiency estimates. Some of the intervals overlap, which suggests that only some of the rankings indicated by the traditional DEA estimates are confirmed.

Table 4
Efficiency scores, bias and confidence interval bounds (2008–2016)

Region		DEA	DEA-BC	Bias	Lower Bound	Upper Bound	Bound Difference
AND	Mean	1.579	1.620	-0.040	1.579	1.647	0.068
	S.D.	0.232	0.226	0.013	0.232	0.222	0.019
ARA	Mean	1.750	1.790	-0.041	1.766	1.813	0.046
	S.D.	0.178	0.182	0.018	0.179	0.184	0.026
AST	Mean	1.704	1.758	-0.053	1.725	1.787	0.062
	S.D.	0.196	0.194	0.019	0.196	0.192	0.023
CANT	Mean	1.478	1.557	-0.079	1.511	1.600	0.090
	S.D.	0.167	0.170	0.025	0.165	0.173	0.032
CASTMAN	Mean	1.756	1.786	-0.030	1.770	1.803	0.033
	S.D.	0.085	0.084	0.008	0.083	0.087	0.011
CAT	Mean	1.316	1.343	-0.027	1.316	1.360	0.044
	S.D.	0.118	0.120	0.012	0.118	0.122	0.025
CLEON	Mean	1.844	1.879	-0.035	1.854	1.901	0.047
	S.D.	0.089	0.085	0.017	0.087	0.085	0.018
CV	Mean	1.570	1.605	-0.035	1.587	1.625	0.038
	S.D.	0.279	0.291	0.023	0.287	0.297	0.023
EXT	Mean	1.710	1.764	-0.054	1.731	1.794	0.063
	S.D.	0.105	0.107	0.011	0.107	0.108	0.021
GAL	Mean	1.899	1.933	-0.034	1.908	1.955	0.047
	S.D.	0.168	0.161	0.013	0.168	0.160	0.014
IB	Mean	1.264	1.329	-0.065	1.294	1.365	0.072
	S.D.	0.187	0.186	0.077	0.187	0.195	0.074
ISCAN	Mean	1.169	1.185	-0.016	1.173	1.194	0.022
	S.D.	0.109	0.108	0.009	0.110	0.107	0.013
MAD	Mean	1.287	1.331	-0.043	1.308	1.354	0.045
	S.D.	0.119	0.120	0.013	0.119	0.119	0.013
MUR	Mean	1.357	1.434	-0.077	1.396	1.476	0.080
	S.D.	0.143	0.147	0.026	0.148	0.146	0.027
NAV	Mean	1.329	1.411	-0.083	1.365	1.453	0.088
	S.D.	0.119	0.123	0.020	0.112	0.125	0.025
PV	Mean	1.333	1.402	-0.068	1.371	1.438	0.067
	S.D.	0.151	0.132	0.030	0.137	0.129	0.022
RIOJ	Mean	1.050	1.175	-0.125	1.120	1.230	0.110
	S.D.	0.040	0.059	0.067	0.043	0.081	0.054
GLOBAL	Mean	1.494	1.547	-0.053	1.516	1.576	0.060
	S.D.	0.291	0.291	0.034	0.284	0.280	0.037
	Max.	2.207	2.245	-0.010	2.232	2.264	0.354
	Min.	1.000	1.021	-0.432	0.991	1.030	0.008

Note: Total number of iterations=2000.

In any case, the results highlight a huge potential output increasing over the period considered. Regarding the efficiency of the hotels located in the different regions, Rioja and the Canary Islands show the highest levels of efficiency for the period analyzed in both models, whereas Galicia, Castilla-León and Castilla-La-Mancha show the lowest levels. Because the bias-corrected bootstrap estimates of efficiency are more robust than the traditional DEA efficiency estimates, we focus only on these estimates (DEA-BC).

Regarding the evolution of efficiency over time, Table 5 shows that the average efficiency of the hotels located in all the regions is steady during the period considered, with low variation over the years. Efficiency scores vary between a minimum of 1.464 in 2008 and a maximum of 1.607 in 2013. In particular, 2013 shows the worst average efficiency scores. However, the evolution of efficiency over time for the different regions is very different.

Whereas several regions improve their efficiency scores between 2008 and 2016 (e.g., Canary Islands), other regions' efficiency worsens (e.g., Aragon), and still others remain steady (e.g., Galicia). These results imply that the evolution of efficiency is not consistent among regions.

Table 5
Evolution of firms' efficiency score (bias-corrected DEA model) per region and year

Region	2008	2009	2010	2011	2012	2013	2014	2015	2016
AND	1.620	1.636	1.640	1.676	1.679	1.669	1.616	1.558	1.481
ARA	1.444	1.694	1.734	1.786	1.901	1.924	1.892	1.880	1.857
AST	1.651	1.665	1.687	1.695	1.798	1.827	1.892	1.839	1.762
CANT	1.516	1.553	1.568	1.589	1.607	1.635	1.616	1.477	1.457
CASTMAN	1.719	1.697	1.683	1.762	1.772	1.842	1.866	1.850	1.882
CAT	1.348	1.424	1.407	1.353	1.343	1.341	1.332	1.291	1.247
CLEON	1.777	1.795	1.831	1.854	1.906	1.979	1.973	1.911	1.890
CV	1.567	1.719	1.676	1.627	1.674	1.639	1.584	1.533	1.431
EXT	1.615	1.685	1.720	1.758	1.824	1.867	1.881	1.795	1.727
GAL	1.878	1.909	1.867	1.903	1.955	2.028	2.012	1.944	1.901
IB	1.380	1.437	1.406	1.357	1.309	1.296	1.322	1.260	1.192
ISCAN	1.222	1.328	1.283	1.176	1.203	1.164	1.113	1.112	1.063
MAD	1.145	1.277	1.332	1.337	1.371	1.435	1.422	1.347	1.311
MUR	1.320	1.400	1.451	1.484	1.542	1.515	1.467	1.397	1.332
NAV	1.301	1.378	1.382	1.469	1.508	1.492	1.463	1.375	1.334
PV	1.239	1.347	1.392	1.463	1.470	1.456	1.460	1.410	1.376
RIOJ	1.145	1.174	1.191	1.158	1.179	1.210	1.195	1.170	1.150
TOTAL									
Mean	1.464	1.536	1.544	1.556	1.591	1.607	1.594	1.538	1.494
S.D.	0.251	0.235	0.236	0.260	0.278	0.302	0.313	0.309	0.310

Furthermore, Table 6 shows that the efficiency of the hotels has a stationary effect in August, when the efficiency is significantly higher. In fact, the summer season (July, August and September) is the most efficient quarter within the year.

Table 6
Efficiency scores (bias-corrected DEA model) per month (2008–2016)

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Mean	1.640	1.604	1.583	1.575	1.588	1.543	1.438	1.364	1.466	1.546	1.612	1.602
S.D.	0.301	0.290	0.267	0.249	0.254	0.274	0.275	0.266	0.269	0.252	0.290	0.261

4.2. Environmental factors affecting regional hotel performance

Finally, to analyze the effect of environmental factors on hotel efficiency, a truncated bootstrapped regression is conducted. The results are shown in Table 7. Overall, the environmental variables considered have a significant effect on the efficiency of the regions. At this point, it must be stressed again that the dependent variable represents the mode of inefficiency; thus, a parameter with a negative sign indicates a positive effect on efficiency, whereas a positive sign indicates a negative effect on efficiency.

Table 7
Determinants of inefficiency: Estimation on bias-corrected efficiency estimates (dependent variable=mode of inefficiency)

Variable	Coefficient	95% Bootstrap Confidence Interval	
		Lower Bound	Upper Bound
Intercept	4.505*	4.028	4.974
International tourists	-0.177*	-0.208	-0.145
Length of stay	-0.118*	-0.134	-0.105
Sun and sand	-0.053*	-0.090	-0.019
Q-Hotels	0.001*	0.001	0.002
Variance	0.268	0.257	0.280

Note: * significant at 0.05; total number of iterations=2000.

Specifically, the number of international tourists arriving in Spain and the length of stay have a positive effect on efficiency. Thus, as the number of international tourists and the length of stay increase, the hotels' efficiency increases. This may occur because these variables positively affect some of the outputs (e.g., the occupancy rate). Generally, international tourists have high purchasing power and a large travel budget, which is expected to increase the average daily rate obtained by the hotels. Accordingly, our results highlight the importance of the foreign market segment in the Spanish hotel sector, in line with similar results found in previous research for different countries (Assaf et al., 2017; Ben Aissa & Goaied, 2016; Chen, 2010; Huang et al., 2012; Hwang & Chang, 2003). The length of stay also has a positive impact on hotel efficiency. Generally, as noted above, the cost of retaining a customer is lower than the cost of acquiring a new one; thus, destinations and hotels themselves should collaborate to offer a sufficiently wide range of activities at the destination to incentivize a longer stay in the hotel. In fact, the length of stay could be seen as a proxy for the region's capacity to attract new visitors.

In addition, the dominance of the sun and sand model is positively associated with efficiency, in line with previous studies (Barros et al., 2011; Benito et al. 2014). In this sense, the average efficiency score of the regions in which this model of tourism is prevalent (1.419) is lower than that of other regions (1.617), showing a higher level of efficiency (see Table 8).

Table 8
Average efficiency scores depending on the sun and sand model (2008–2016)

	Non-Sun and Sand	Sun and Sand	Global
Mean	1.617	1.419	1.547
S.D.	0.276	0.245	0.282

Although this tourism model faces many challenges, such as stronger demand by consumers, greater importance of cultural factors and new tourist habits, it has also been managed to meet the expectations of a growing demand, with the introduction of innovations and special attention paid to individual needs (Aguiló et al., 2005). In addition, the sun and sand model still represents an important source of revenue and employment for the Spanish tourist sector.

Finally, the variable that captures hotel quality has a positive and significant parameter, which shows that this variable has a negative effect on the regions' efficiency. Although this result might be surprising, it is explained by the fact that the inputs required to offer high-quality service are larger. Despite the fact that customers who purchase accommodations in a higher-quality hotel pay a higher rate, the costs associated with the service are also higher for the hotel and, thus, the final effect on efficiency is negative. In fact, the high cost implied in the initial investment when implementing a quality system has a strong effect on industries with huge fixed costs, such as the hotel sector, since that initial high cost can have a significant influence on the operating leverage of the firm (Nicolau & Sellers, 2011). These high fixed costs make hotels strongly revenue dependent, which leads them to suffer from profit instability during periods of shifting demand (Graham & Harris, 1999). In this sense, some authors have noted a negative relationship related to the time and expenses behind adherence to official quality certification (Ingram & Daskalakis, 1999). Fernández and Becerra (2015) also found a negative relationship between quality and efficiency and concluded that the disadvantages related to increased quality (expenses, time, bureaucracy) might have affected that result.

5. Discussion and conclusion

The purpose of this study is threefold. First, this research extends the literature on hotel efficiency from a regional perspective. Second, we examine the role of four novel environmental variables in regional hotel efficiency. To the best of our knowledge, these variables have not been used together before to explain hotel efficiency on a regional basis. Third, we focus on the case of Spain, the country that topped the most recent edition of the TTCI (World Economic Forum, 2017). We employ stochastic DEA applied to monthly data from the hotel industry established in 17 Spanish regions for the period 2008–2016.

Overall, the results reveal a high degree of hotel inefficiency for the regions examined. The most efficient regions are La Rioja and Canary Islands, whereas Galicia, Castilla-León and Castilla-La-Mancha show the lowest levels of efficiency. The results of the truncated bootstrapped regression show that the environmental variables considered have a significant effect on the efficiency of the regions. The number of international tourists and length of stay have a positive effect on regional hotel efficiency, probably due to their positive effect on the occupancy rate and to the high travel budget of international tourists, which positively affects the average daily rate obtained by hotels. For destination quality, the results show a negative effect on regional hotel efficiency, which could be explained by the costs inherent to obtaining and maintaining quality certification. Finally, the dominance of the sun and sand model is also positively associated with efficiency. Despite all the concerns that this form of tourism raises, these results show that the net effect on hotel performance in the Spanish regions considered is positive.

The present study also enhances knowledge of the huge diversity of Spain as a leading tourist destination, diversity that is reflected in the different regions (also named autonomous communities) into which Spain is politically and administratively divided. The Spanish government, as well as governments from different countries with similar characteristics, could use these results to better allocate resources to attract tourists and enhance hotel performance.

The results obtained have significant implications for policymakers. It should be highlighted that Spanish regional governments carry out important tourism marketing campaigns devoted to promoting their destinations and attracting tourists. Thus, they are also co-responsible for the results of the hotels located in their regions. In this sense, estimations of the different regions' efficiency might be used as external benchmarks. From a regional perspective, the process of benchmarking requires measuring the difference between the current performance level of a region and best possible practice to later identify the underlying causes of this difference. In terms of efficiency, this process implies that an inefficient region should examine the reasons why other regions are more efficient. In other words, considering the efficiency with which different regions operate enables the identification of the determinant causes of their different efficiency levels, which finally allows for the measurement of the value of the different strategies adopted. In particular, the results show a positive impact of international tourist arrivals and length of stay on efficiency, highlighting the importance of focusing on international markets (e.g., emerging markets such as China and India, according to WEF 2017), and offering activities that allow for increasing the length of stay in the destination. Furthermore, quality has a negative effect on efficiency. Although commitment to quality is important for attracting high-income tourists, it also increases the cost of the service provided. Thus, the final effect needs to be monitored.

Future studies are encouraged to validate the proposed model in different countries but also with different, geographically smaller units of analysis (e.g., provinces, municipalities, tourist districts or cities), in line with recent work (Marco-Lajara, Claver-Cortés, Úbeda-García, & Zaragoza-Sáez, 2016). Additionally, future research could examine the effect of different indicators on regional hotel efficiency. In this sense, it would be possible to include other relevant variables in the production process of the hotels, such as the degree of technological development of the companies themselves. New technologies and e-commerce affect, for example, the destination's visibility and subsequent regional competitiveness and performance. Finally, this paper provides a starting point for the study of other factors causing the observed efficiency differences. A lack of information impedes the analysis of other efficiency determinants, such as the strength of destination brands, advertising investment or the type of advertising campaigns and media used by the regions. Furthermore, residents' perceptions about tourism could influence hotel efficiency on a regional basis. Recent news has shown local residents' great discomfort in some of the big tourist cities due to the huge number of visitors these cities receive (*The Guardian*, 2017). In fact, governments from different countries and regions plan to develop different strategies (e.g., taxes) aimed at deterring "the masses". It could also be of interest to include measures of tourists' experiences or perceptions of destinations. Finally, in line with the recommendations of the World Economic Forum (2017), the future of tourism is probably tied to the need to reach sustainable growth: the better the natural environment of a country is, the more tourists are inclined to visit it. Additional research is needed on the relationship between sustainable measures (e.g., international environmental standards) and hotel efficiency.

References

Abrate, G., Capriello, A., & Fraquelli, G. (2011). When quality signals talk: Evidence from the Turin hotel industry. *Tourism Management*, *32*, 912–921.

Akbaba, A. (2006). Measuring service quality in the hotel industry: A study in a business hotel in Turkey. *International Journal of Hospitality Management, 25*(2), 170–192.

Aguiló, P. M., Alegre, J., & Riera, A. (2001). Determinants of the price of German tourist packages on the island of Mallorca. *Tourism Economics, 7*(1), 59–74.

Aguiló, E., Alegre, J., & Sard, M. (2005). The persistence of the sun and sand tourism model. *Tourism Management, 26*, 219–231.

Aguiló, E., & Juaneda, C. (2000). Tourist expenditure for mass tourism markets. *Annals of Tourism Research, 27*, 624–637.

Anderson, R. I., Fish, M., Xia, Y., & Michello, F. (1999). Measuring efficiency in the hotel industry: A stochastic frontier approach. *International Journal of Hospitality Management, 18*, 45-57.

Anderson, R. I., Fok, R., & Scott, J. (2000). Hotel industry efficiency: An advanced linear programming examination. *American Business Review*, *18*(1), 40-48.

Arbelo-Pérez, M., Arbelo, A., & Pérez-Gómez, P. (2017). Impact of quality on estimations of hotel efficiency. *Tourism Management, 61*, 200–208.

Assaf, A., Barros, C. P., & Josiassen, A. (2012). Hotel efficiency: A bootstrapped metafrontier approach. *International Journal of Hospitality Management, 31*, 621–629.

Assaf, A. G., & Cvelbar, L. K. (2010). Privatization, market competition, international attractiveness, management tenure and hotel performance: Evidence from Slovenia. *International Journal of Hospitality Management, 30*(2), 391-397.

Assaf, A. G., & Josiassen, A. (2016). Frontier analysis: A state-of-the-art review and meta-analysis. *Journal of Travel Research, 55*(5), 612–627.

Assaf, A. G., & Josiassen, A. (2012). Identifying and ranking the determinants of tourism performance: A global investigation. *Journal of Travel Research, 51*(4), 388–399.

Assaf, A. G., Josiassen, A., & Agbola, F. W. (2015). Attracting international hotels: Locational factors that matter most. *Tourism Management, 47*, 329–340.

Assaf, A. G., Josiassen, A., Cvelbar, L. K., & Woo, L. (2015). The effects of customer voice on hotel performance. *International Journal of Hospitality Management*, *44*, 77-83.

Assaf, A. G., Josiassen, A., Woo, L., Agbola, F. W., & Tsionas, M. (2017). Destination characteristics that drive hotel performance: A state-of-the-art global analysis. *Tourism Management, 60,* 270–279.

Assaf, A. G., & Magnini, V. (2012). Accounting for customer satisfaction in measuring hotel efficiency: Evidence from the US hotel industry. *International Journal of Hospitality Management, 31,* 642-647.

Ball, S. D., Johnson, K., & Slattery, P. (1986). Labour productivity in hotels: An empirical analysis. *International Journal of Hospitality Management, 5*(3), 141-147.

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science, 30*(9), 1078–1092.

Barros, C. P. (2005a). Measuring efficiency in the hotel sector. *Annals of Tourism Research, 32*(2), 456-477.

Barros, C. P. (2005b). Evaluating the efficiency of a small hotel chain with a Malmquist productivity index. *International Journal of Tourism Research*, *7*(3), 173-184.

Barros, C. P. (2004). A stochastic cost frontier in the Portuguese hotel industry. *Tourism Economics, 10*(2), 177-192.

Barros, C. P., & Alves, F. P. (2004). Productivity in the tourism industry. *International Advances in Economic Research, 10*(3), 215-225.

Barros, C. P., Botti, L., Peypoch, N., Robinot, E., Solonandrasana, B., & Assaf, A. (2011). Performance of French destinations: Tourism attraction perspectives. *Tourism Management, 32*, 141–146.

Barros. C. P., & Dieke, P. U. C. (2008). Technical efficiency of African hotels. *International Journal of Hospitality Management, 27*(3), 438-447.

Barros, C. P., & Machado, L. P. (2010). The length of stay in tourism. *Annals of Tourism Research, 37*(3), 692–706.

Ben Aissa, S., & Goaied, M. (2016). Determinants of tourism hotel market efficiency. *International Journal of Culture, Tourism and Hospitality Research, 10*(2), 173–190.

Benito, B., Solana, J., & López, P. (2014). Determinants of Spanish regions' tourism performance: A two-stage, double-bootstrap data envelopment analysis. *Tourism Economics, 20*(5), 987–1012.

Bernard, A. B., & Jensen, J. B. (2004). Exporting and productivity in the USA. *Oxford Review of Economic Policy, 20*(3), 343–357.

Botti, L., Peypoch, N., Robinot, E., & Solonandrasana, B. (2009). Tourism destination competitiveness: The French regions case. *European Journal of Tourism Research, 21*, 5–24.

Botti, L., Peypoch, N., & Solonandrasana, B. (2008). Time and tourism attraction. *Tourism Management, 29*(3), 594–596.

Brida, J. G., Garrido M., Deidda, M., & Pulina M. (2012). Exploring the dynamics of the efficiency in the Italian hospitality sector. A regional case study. *Expert Systems with Applications, 39*(10), 9064–9071.

Brown, J. R., & Ragsdale, C. T. (2002). The competitive market efficiency of hotel brands: An application of data envelopment analysis. *Journal of Hospitality & Tourism Research, 26*(4), 332-360.

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research, 2*(6), 429–444.

Charnes, A., Cooper, W. W., & Rhodes, E. (1981). Evaluating program and managerial efficiency: An application of data envelopment analysis to program follow through. *Management Science, 27*(6), 668–697.

Chen, M. H. (2010). The economy, tourism growth and corporate performance in the Taiwanese hotel industry. *Tourism Management, 31*(5), 665–675.

Chen, W. J. (2013). Factors influencing internal service quality at international tourist hotels. *International Journal of Hospitality Management, 35*, 152–160.

Claver-Cortés, E., Molina-Azorín, J. F., & Pereira-Moliner, J. (2007). The impact of strategic behaviors on hotel performance. *International Journal of Contemporary Hospitality Management, 19*(1), 6–20.

Cracolici, M. F., & Nijkamp, P. (2008). The attractiveness and competitiveness of tourist destinations: a study of Southern Italian regions. *Tourism Management, 30*, 336–344.

Cracolici, M. F., Nijkamp, P., & Rietveld, P. (2008). Assessment of tourist competitiveness by analysing destination efficiency. *Tourism Economics, 14*, 325–342.

Crouch, G., & Ritchie, J. (1999). Tourism, competitiveness, and societal prosperity. *Journal of Business Research, 44*, 137–152.

De Jorge, J. & Suárez, C. (2014). Productivity, efficiency and its determinant factors in hotels. *The Service Industries Journal, 34*(4), 354-372.

Detotto, C., Pulina, M., & Brida, J. G. (2014). Assessing the productivity of the Italian hospitality sector: A post-WDEA pooled-truncated and spatial analysis. *Journal of Productivity Analysis, 42*, 103–121.

Espinet, J. M., Saez, M., Coenders, G., & Fluvià, M. (2003). Effect on prices of the attributes of holiday hotels: a hedonic prices approach. *Tourism Economics, 9*(2), 165–177.

Eurostat (2017). Tourism satellite accounts in Europe. 2016 Edition. Available from internet: http://ec.europa.eu/eurostat/documents/7870049/7880233/KS-FT-17-002-EN-N.pdf/1070ebdc-b9e1-4a93-abb8-cecd83d40f68. Accessed 29 Apr 2017.

Fernández, M. A., & Becerra, R. (2015). An analysis of Spanish hotel efficiency. *Cornell Hospitality Quarterly, 56*(3), 248–257.

Gomezeljn, D. O., & Mihalic, T. (2008). Destination competitiveness - applying different models: the case of Slovenia. *Tourism Management, 29*(2), 294–307.

Graham, I. C., & Harris, P. J. (1999). Development of a profit planning framework in an international hotel chain: a case study. *International Journal of Contemporary Hospitality Management, 11*(5), 198–204.

Guccio, C., Lisi, D., Martorana, M., & Mignosa, A. (2017). On the role of cultural participation in tourism destination performance: An assessment using robust conditional efficiency approach. *Journal of Cultural Economics, 41*(2), 129–154.

Huang, Y., Mesak, H. I., Hsu, M. K., & Qu, H. (2012). Dynamic efficiency assessment of the Chinese hotel industry. *Journal of Business Research, 65*, 59–67.

Hwang, S. N., & Chang, T. Y. (2016). Formulating management strategy for international tourist hotel using DEA. In J. Zhu (Ed), *Data Envelopment Analysis* (pp. 289–316). Springer.

Hwang, S. N., & Chang, T. Y. (2003). Using data envelopment analysis to measure hotel managerial efficiency change in Taiwan. *Tourism Management*, *24*(4), 357–369.

INE (2016). Estadísticas de movimientos turísticos en frontera, Frontur - Encuesta de gasto turístico, Egatur [Tourist movement on borders survey, Frontur – Tourist expenditure survey, Egatur]. Retrieved from http://www.ine.es/dyngs/INEbase/es/categoria.htm?c=Estadistica_P&cid=1254735570703. Accessed December 20, 2017.

Ingram, H., & Daskalakis, G. (1999). Measuring quality gaps in hotels: The case of Crete. *International Journal of Contemporary Hospitality Management, 11*(1), 24–30.

Ioannides, D., & Debbage, K. (1997). Post-Fordism and flexibility: The travel industry polyglot. *Tourism Management, 18*(4), 229–241.

Ivars-Baidal, J. A. (2004). Regional tourism planning in Spain: Evolution and perspectives. *Annals of Tourism Research, 31*(2), 313–333.

Johns, N., Howcroft, B., & Drake, L. (1997). The use of data envelopment analysis to monitor hotel productivity. *Progress in Tourism and Hospitality Research, 3*, 119-127.

Knowles, T., & Curtis, S. (1999). The market viability of European mass tourist destinations. A post-stagnation life-cycle analysis. *International Journal of Tourism Research, 1*(2), 87–96.

Lado-Sestayo, R., Otero-González, L., Vivel-Búa, M., & Martorell-Cunill, O. (2016). Impact of location on profitability in the Spanish hotel sector. *Tourism Management, 52*, 405–415.

López-Fernández, M. C., & Serrano-Bedia, A. M. (2004). Is the hotel classification system a good indicator of hotel quality? An application in Spain. *Tourism Management, 25*, 771–775.

Marco-Lajara, B., Claver-Cortés, E., Úbeda-García, M., & Zaragoza-Sáez, P. C. (2016). Hotel performance and agglomeration of tourist districts. *Regional Studies, 50*(6), 1016–1035.

Morey, R. C., & Dittman, D. A. (1995). Evaluating a hotel GM's performance: A case study in benchmarking. *Cornell Hotel and Restaurant Administration Quarterly, 36*, 30-35.

Nicolau, J. L., & Sellers, R. (2011). The effect of quality on hotel risk. *Tourism Economics, 17*(1), 39–52

Núñez-Serrano, J. A., Turrión, J., & Velázquez, F. J. (2014). Are stars a good indicator of hotel quality? Asymmetric information and regulatory heterogeneity in Spain. *Tourism Management, 42*, 77–87.

Oliveira-Santos, G. E., Ramos, V., & Rey-Maquieira, J. (2015). Length of stay at multiple destinations of tourism trips in Brazil. *Journal of Travel Research*, *54*(6), 788–800.

Oliveira, R., Pedro, M. I., & Marques, R. C. (2013a). Efficiency and its determinants in Portuguese hotels in the Algarve. *Tourism Management, 36*, 641–649.

Oliveira, R., Pedro, M. I., & Marques, R. C. (2013b). Efficiency performance of the Algarve hotels using a revenue function. *International Journal of Hospitality Management*, *35*, 59–67.

Parte-Esteban, L. & Alberca-Oliver, P. (2015a). Determinants of technical efficiency in the Spanish hotel industry: Regional and corporate performance factors. *Current Issues in Tourism, 8*(4), 301-411.

Parte-Esteban, L. & Alberca-Oliver, P. (2015b). New insights into dynamic efficiency: the effects of firm factors. *International Journal of Contemporary Hospitality Management, 27*(1), 107-129.

Pérez-Rodríguez, J. V., & Acosta-González, E. (2007). Cost efficiency of the lodging industry in the tourist destination of Gran Canaria (Spain). *Tourism Management, 28*(4), 993–1005.

Porter, M. (1998). Clusters and the new economics of competition. *Harvard Business Review, 76*(6), 77–90.

Pulina, M., Detotto, C., & Paba, A. (2010). An investigation into the relationship between size and efficiency of the Italian hospitality sector: A window DEA approach. *European Journal of Operational Research, 204*, 613–620.

Reynolds, D. (2003). Hospitality-productivity assessment using data-envelopment analysis. *The Cornell Hotel and Restaurant Administration Quarterly, 44*(2), 130-137.

Reynolds, D., & Biel, D. (2007). Incorporating satisfaction measures into a restaurant productivity index. *International Journal of Hospitality Management*, *26*(2), 352-361.

Ritchie, J. R. B. & Crouch, G. I. (2003). *The competitive destination: A sustainable perspective*. Wallingford, UK: CABI.

Rosenbaum, S. M., & Spears, D. L. (2006). An exploration of spending behaviors among Japanese tourists. *Journal of Travel Research*, *44*(4), 467–473.

Shang, J-K., Hung, W-T., Lo, C-F., & Wang, F-C. (2008). Ecommerce and hotel performance: three-stage DEA analysis. *The Service Industries Journal, 28*(4), 529-540.

Simar, L., & Wilson, P. W. (2011) Two-Stage DEA: Caveat emptor. *Journal of Productivity Analysis, 36*, 205–218.

Simar, L., & Wilson, P. W. (2007). Estimation and inference in two-stage, semi-parametric models of productive efficiency. *Journal of Econometrics, 136*, 31–64.

Simar, L., & Wilson, P. W. (2000a). Statistical inference in nonparametric frontier models: The state of the art. *Journal of Productivity Analysis, 13*(1), 49–78.

Simar, L., & Wilson, P. W. (2000b). A general methodology for bootstrapping nonparametric frontier models. *Journal of Applied Statistics, 27*(6), 779–802.

Simar, L., & Wilson, P. W. (1998). Sensitivity analysis of efficiency scores: how to bootstrap in nonparametric frontier models. *Management Science, 44*(1), 49–61.

Simm, J., & Besstremyannaya, G. (2016). rDEA: Robust Data Envelopment Analysis (DEA) for R, R package version 1.2-5, https://CRAN.R-project.org/package=rDEA.

Solana-Ibáñez, J., Caravaca-Garratón, M., & Para-González, L. (2016). Two-stage data envelopment analysis of Spanish regions: Efficiency determinants and stability analysis. *Contemporary Economics, 10*(3), 259–274.

Taylor, P. (1995). Measuring changes in the relative competitiveness of package tour destinations. *Tourism Economics, 1*, 169–182.

The Guardian (2017). Barcelona marches to curb negative effects of tourism boom. Available at: https://www.theguardian.com/world/2017/jan/29/barcelona-residents-protest-high-rents-fuelled-by-tourism. Accessed 29 June 2017.

Thrane, C. (2005). Hedonic price models and sun-and-beach package tours: The Norwegian case. *Journal of Travel Research*, *43*, 302–308.

Tsaur, S-H. (2001). The operating efficiency of international tourist hotels in Taiwan. *Asia Pacific Journal of Tourism Research, 6*(1), 73-81.

Wang, Y-H., Lee, W-F., & Wong, C-C. (2007). Productivity and efficiency analysis of international tourist hotels in Taiwan: An application of the stochastic frontier approach. *Taiwan Economic Review, 35*, 87-114.

Weng, C-C. & Wang, K-L. (2006). Scale and scope economies of international tourist hotels in Taiwan. *Tourism Management, 27*, 25-33.

World Economic Forum (2017). The Travel & Tourism Competitiveness Report 2017. Geneva, Switzerland. Available at: http://www.weforum.org. Accessed 1 June 2017.

Xiao, Q., O'Neill, J. W., & Mattila, A. S. (2012). The role of hotel owners: The influence of corporate strategies on hotel performance. *International Journal of Contemporary Hospitality Management, 24*(1), 122–139.

Yang, Z., & Cai, J. (2016). Do regional factors matter? Determinants of hotel industry efficiency in China. *Tourism Management, 52*, 242–253.

Yang, Z., Xia, L., & Cheng, Z. (2017). Performance of Chinese hotel segment markets: Efficiencies measure based on both endogenous and exogenous factors. *Journal of Hospitality and Tourism Management*, *32*, 12–23.

Yin, P., Tsai, H., & Wu, J. (2015). A hotel life cycle model based on bootstrap DEA efficiency. The case of international tourist hotels in Taipei. *International Journal of Contemporary Hospitality Management, 27*(5), 918-937.